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**Rocky Mountain
Remediation Services, L.L.C.**
... protecting the environment

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March 4, 1997

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ACCOMPLISHMENT OF PERFORMANCE MEASURE FOR THE TRENCH
T-1 REMEDIATION PROCESS DETERMINATION - AMT-025-97

Action: Submittal of Notification and Approval letter to the Department of Energy, Rocky Flats Field Office

Rocky Mountain Remediation Services (RMRS) Environmental Remediation Projects' Accelerated Actions Group has accomplished the Performance Measure for the Trench T-1 Remediation process determination. A review of process treatment alternatives for the depleted uranium chips and other wastes removed from Trench T-1 concluded that stabilization of the chips is the best possible alternative. Stabilization, or cementation is a technique used frequently within the DOE complex and commercially (see attached Treatment Alternatives Summary Report).

RMRS is currently planning the implementation of this process and will begin drafting the Decision Document utilizing stabilization as the preferred treatment alternative. Please submit notification to the Department of Energy, Rocky Flats Field Office of our intent to proceed.

Please contact Mark Burmeister at x5891, or Susan Evans at x3199 with any questions.


Ann M. Tyson
Vice President
Environmental Restoration

MCB/aw

Enclosure:
As Stated

cc:
K. North
A. Sieben

[illegible]

CLASSIFICATION:

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IN REPLY TO RF CC NO.:

ACTION ITEM STATUS:

☐ PARTIAL/OPEN
☐ CLOSED

LTR APPROVALS:

ORIGINAL TYPIST INITIALS:

MCB:aw
RF-46469 (Rev. 1/97)

ADMIN RECORD
1108-A-00006

TREATMENT ALTERNATIVES SUMMARY REPORT

TRENCH T-1

Brief History

Trench T-1 is located just north of Central Avenue, west of the inner east access gate, and south and southeast of the Mound Area. The trench is approximately 250 feet long, 15 feet wide, and 10 feet deep. Records indicate that approximately 25,000 kilograms of unoxidized depleted uranium machining chips (uranium-238) and water soluble lathe coolant oils in an estimated 125 drums are buried in Trench T-1. Burial of depleted uranium (DU) in Trench T-1 began in December 1954 and ended in December 1962. The drums were covered with approximately 2 to 5 feet of soil.

Based on existing records, process knowledge, and interviews with former workers, all of the drums in Trench T-1 are believed to have originated from Building 444. Building 444 is a multi-purpose manufacturing facility with emphasis on manufacturing DU and beryllium components. Depleted uranium, depleted uranium alloys, and beryllium were the main metals used.

In addition to the depleted uranium chips in coolant oils, other wastes are documented as being buried in Trench T-1. These wastes include ten (10) drums of cemented cyanide waste and possibly one drum of still bottoms of unknown composition. Groundwater wells in the vicinity do not indicate contaminant plumes originating from the Trench T-1 boundaries. If present, only minor volatile organic contamination is expected within the trench.

In spring 1995, a series of electromagnetic (EM) and ground penetrating radar (GPR) surveys were performed at the Trench T-1 site. The EM and GPR indicate that the bulk of the buried drums are located at the west end, and to a lesser extent the east end of the trench. Based on discussions, and interviews with retired workers, the drums containing the DU are believed to be buried in the western end of the trench; the eastern end of the trench is expected to contain crushed drums and construction debris (pallets, drum fragments, glass, etc.). A small amount of metallic objects and debris was also identified in the center of the trench.

Treatment Alternatives

The purpose of the Trench T-1 Remediation project is to excavate the material which was buried in the trench along with associated soils contaminated above RFCA Tier I Action Levels, and treat, and/or prepare it for disposal at a suitable disposal facility. In order to safely transport and dispose of depleted uranium chips, the waste must be treated. Three potential treatment technologies which have been utilized within the Department of Energy (DOE) complex for uranium chips and fines were examined:

- thermal oxidation;
- chemical oxidation; and
- stabilization.

Thermal Oxidation

Thermal oxidation involves roasting reactive metal in air. This process has historically been used within the DOE complex (Hanford, Oak Ridge, Fernald, and Rocky Flats) for treatment of uranium metal chips prior to reuse or disposal. The principle advantage for thermal oxidation is that the exothermic and pyrophoric qualities of uranium metal are removed by conversion of the material to uranium oxide. If the resultant uranium oxide was acceptable for disposal without further treatment, there would be advantages in container and disposal volume efficiencies.

Thermal oxidation processes require extensive cooling, ventilation, and monitoring equipment to address environmental and safety concerns. Temperatures sufficient to oxidize the uranium have been determined to be in the 1300° to 1500° C range (2000° - 2700° F). The reaction is essentially uncontrolled, and hot spots can form in proximity to container walls. The temperature range noted approaches the melting point of stainless steel (1450° C). Generation of uranium particulates and high temperature gas requires a reliable off-gas treatment system.

Chemical Oxidation

Chemical oxidation is an aqueous process for controlled oxidation of uranium metal in an oxidizing solution. Pilot-scale testing of chemical oxidation of uranium metal has been performed at Los Alamos National Laboratory (LANL). The basis of the technology is mild solution oxidation using aqueous sodium hypochlorite (bleach). Common bleach was chosen as the oxidant because of its low cost, public familiarity, and effectiveness in producing a complete and controllable conversion of the metal to oxide.

The principle advantage of chemical oxidation is that the uranium metal achieves the same non-reactive oxide state as thermal oxidation without the high temperatures, and air emissions noted for thermal oxidation. The low temperatures associated with chemical oxidation minimizes the potential for radionuclide release, explosion or uncontrolled oxidation. Full scale experience with this technology is lacking. Pretreatment may be required for oils, solvents, and other materials (soils). The resulting uranium oxide (a finely divided yellow powder) is suitable for disposal after solidification, or for recycle. Secondary waste streams generated are chlorine and hydrogen off-gases, and a radioactive aqueous stream heavy in sulfate and chloride salts.

Stabilization

Direct stabilization or solidification of uranium metal chips and fines has been accomplished at several DOE sites (Hanford, Rocky Flats, and Los Alamos), and other industries (Nuclear Fuel Services (NFS) at the NFS facility in Erwin, Tennessee, Chem-Nuclear Systems Inc. (CNSI) at the General Electric Facility in Evandale, Ohio, and Morrison-Knudsen at the Army Materials Testing Laboratory (AMTL) in Watertown, Massachusetts) for treatment prior to disposal. Stabilization involves mixing the waste material with a cement-based mixture to form a stable block where uranium is isolated from oxygen and moisture.

The principle advantage of stabilization is that the hazards, by-products, and additional steps associated with oxidation are removed. Stabilization encases the uranium and renders it non-reactive in a stable monolith. Underlying contaminated soils associated with the uranium metal chips could be treated without separation. The disadvantage associated with stabilization is that sizing of waste materials may be necessary, to render the material in a form which could be mechanically mixed with the cement. Uranium turnings encountered are likely to be "steelwool-like" objects too large to properly mix. Material such as this may require a chopping or shredding step prior to introducing into a mixing system. Additionally, an increase in waste volumes is expected (estimated 50%), due to addition of the stabilizing agent.

Team Assessment

After evaluating the three treatment alternatives, and discussing these in detail, the Project Team selected stabilization as the preferred alternative. Stabilization is a safe, proven, widely used, and cost effective method for stabilizing the mixture of soils, uranium chips, and associated debris expected in Trench T-1. Additionally, secondary waste streams are minimized, and the equipment required to perform the stabilization is primarily "off-the-shelf" equipment (ie. drum shredder, cement mixer, etc.).

Empty crushed drums, drum fragments, etc. can effectively be shredded and encapsulated within the cement matrix with the DU chips. Cemented cyanide wastes if encountered, if not already meeting the necessary waste disposal requirements, will be encapsulated similarly. Other excavated materials, not suitable for stabilization will be segregated and handled appropriately.

Thermal desorption has been selected for contingency treatment of soils contaminated with volatile organic compounds (VOC's) above RFCA Tier I Action Levels encountered within Trench T-1. If VOC-contaminated soils are encountered above Tier I Action Levels, these soils will be excavated and either stored in roll-off containers or stockpiled until a thermal desorption unit is available on-site to treat the soils. At this time, VOC contamination above Tier I levels is not anticipated, but is being addressed as a contingency.

Debris from the eastern portion of the trench will be evaluated for the presence of contamination using field screening instrumentation, and a determination of whether or not decontamination is necessary prior to disposal of the debris as low-level waste will be made at that time.

Activity Control Envelope (ACE)

The selection of stabilization as the preferred treatment alternative for depleted uranium chips, and associated wastes from Trench T-1 was validated by the T-1 Activity Control Envelope (ACE) team on January 28, 1997. The ACE documentation provides an analysis of the work, including a detailed flow chart of the work, and a hazard assessment. The ACE team consists of a team of individuals with relevant knowledge and experience.

In choosing stabilization as the preferred alternative, the ACE team initially developed a list of treatment criteria and then evaluated each of the criteria and weighted each as to its importance. Finally, the team ranked each of the individual processes as to how well it met each criteria. The highest total score was the process selected. Stabilization was chosen by a significant score (more than twice that of the runner-up) utilizing this process.